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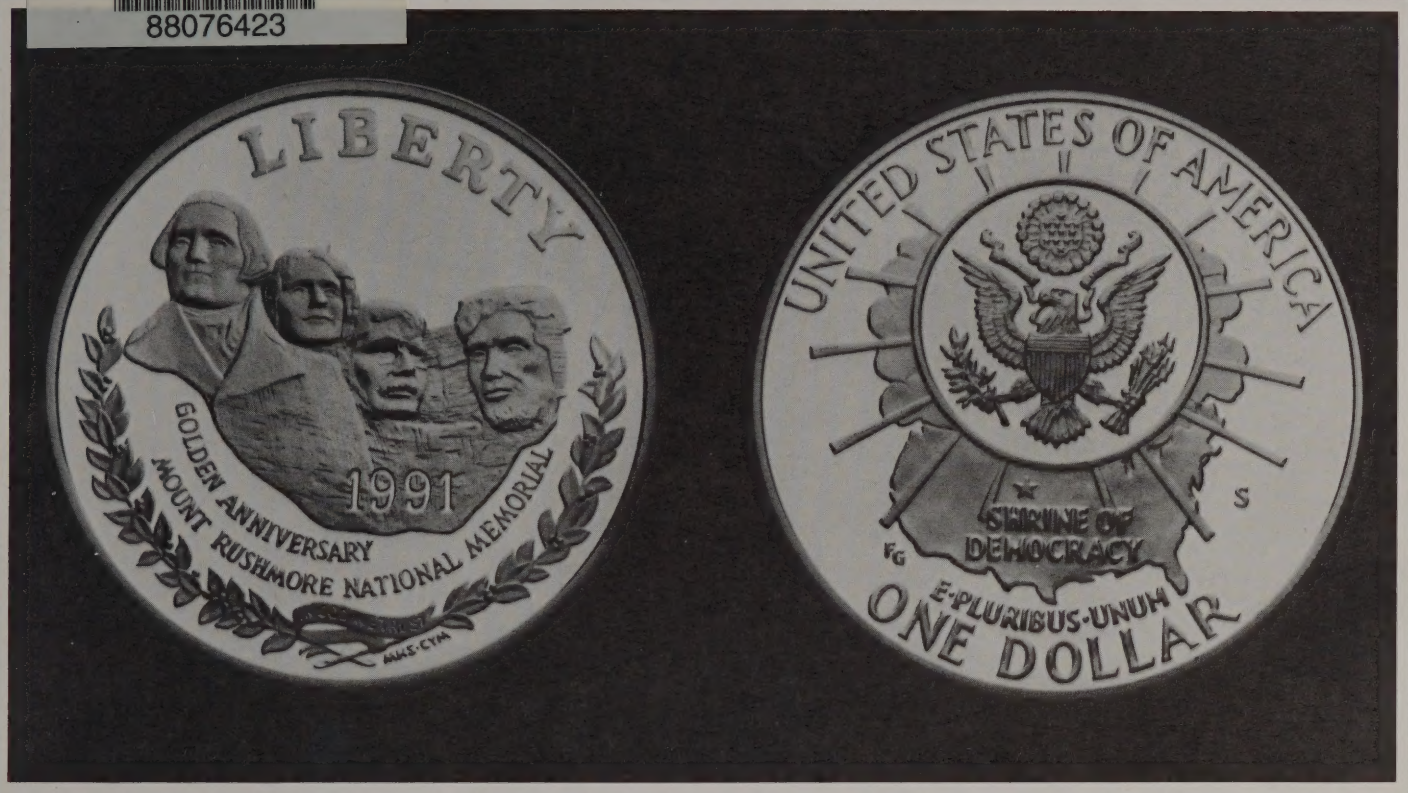

SILVER

By Robert G. Reese, Jr.

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SILVER

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Director

December 1992

Contents

Domestic Data Coverage 1
Background 1
  Definitions, Grades, and Specifications 2
  Uses and Products for Trade and Industry 2
  Geology-Resources 3
  Technology 3
    Mining 3
    Beneficiation 3
  Economic Factors 3
  Operating Factors 4
Annual Review 4
  Legislation and Government Programs 4
  Production 4
    Alaska 4
    Arizona 5
    Idaho 5
    Montana 5
    Nevada 6
    Other States 7
  Consumption and Uses 7
  Stocks 7
  Markets and Prices 7
  Foreign Trade 8
  World Review 8
    Australia 8
    Bolivia 8
    Canada 8
    Chile 9
    Mexico 9
    New Zealand 9
    Papua New Guinea 9
Outlook 9

Tables

Table 1.—Salient Silver Statistics . 11
Table 2.—Mine Production of Recoverable Silver in the United States, by State 12
Table 3.—Mine Production of Recoverable Silver in the United States, by Month 12
Table 4.—Twenty-Five Leading Silver-Producing Mines in the United States in 1991, in Order of Output 13
Table 5.—Silver Produced in the United States, by State, Type of Mine, and Class of Ore 14
Table 6.—Silver Produced in the United States by Cyanidation . . 15
Table 7.—Lode Silver Produced in the United States, by State 16
Table 8.—U.S. Refinery Production of Silver 17
Table 9.—Annual U.S. Fabrication Demand 17
Table 10.—Yearend Stocks of Silver in the United States 18
Table 11.—U.S. Silver Prices 18
Table 12.—U.S. Exports of Silver, by Country 19
Table 13.—U.S. Imports for Consumption of Silver, by Country 20
Table 14.—World Annual Silver Production Capacity, December 31, 1991 21
Table 15.—Silver: World Mine Production, by Country 22
Table 16.—Silver: World Fabrication Demand 24

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COVER PHOTO:
U.S. Department of the Treasury, U.S. Mint photograph of the Mount Rushmore silver commemorative coin. The coin is legal tender, has a $1 face value, weighs 26.73 grams, and contains 90% silver and 10% copper.

SILVER

By Robert G. Reese

Mr. Reese, a physical scientist with the Branch of Metals, has been the commodity specialist for silver for 10 years. Domestic survey data were prepared by Lisa Conley and Dwayne Penn, mineral data assistants; and international data tables were prepared by Virginia Woodson, international data coordinator.

Domestic silver production decreased for the first time in 5 years. A number of mines, including both primary and byproduct silver producers, either reduced their level of operation or ceased mining entirely. The domestic economic recession and low prices for silver and some other metals were cited by company officials when discussing their decisions regarding production levels.

The Government continued to reduce its silver holdings. The Bureau of the Mint produced three commemorative coins during the year. The National Defense Stockpile (NDS) was the source of the silver used in the three coin series.

The average annual domestic silver price fell for the fourth consecutive year. The low price for the year as quoted by Handy and Harman was the lowest daily price since January 1974. Analysts attributed the continued weak price to a lack of investor demand combined with a drop in industrial demand.

The domestic apparent demand for refined silver was 3,846 metric tons in 1991. Apparent demand measures both the quantity of silver required by domestic manufacturers and the quantity of silver demanded by U.S. investors. The decrease in apparent demand was attributed primarily to the domestic recession and a lack of investor demand. An estimate of domestic consumption derived by the CPM Group for the Silver Institute was published in mid-1992. According to analysts at CPM, domestic silver consumption in 1991 was lower than that in the previous year.

DOMESTIC DATA COVERAGE

Domestic mine production data for silver were developed by the U.S. Bureau of Mines from four separate, voluntary surveys of U.S. operations. Typical of these surveys was the lode mine production survey of copper, gold, lead, silver, and zinc. Of the 141 silver-producing lode mines to which a survey form was sent, 129 responded, accounting for an estimated 94% of the total U.S. mine production shown in tables 1, 2, 3, 5, 6, and 7.

BACKGROUND

Silver has played an important role in peoples' lives since ancient times. Early people used silver for ornaments and utensils and as a substance that could be bartered for other goods and services. This concept of the "value" of silver eventually led to its use as the standard in monetary systems, such as that of the Roman Empire, and as a means of paying for international trade. Silver continued to be the standard for most currencies until the discovery of major silver deposits in Mexico and Peru. As more silver deposits were discovered in the 18th and 19th centuries, countries gradually abandoned silver as the standard for their currencies in favor of a gold standard.

Expanding industrial use of silver eventually led to the elimination of silver in U.S. coinage. In the early 1960's, the U.S. Department of the Treasury became a major supplier of silver to industrial consumers. The Treasury, however, had insufficient stocks both to meet industrial demand and to maintain an adequate supply of circulating silver coinage for a prolonged period. When the silver price reached $1.29 per ounce, the value of the silver in a silver dollar equaled $1 in currency. At silver prices greater than $1.29, the silver in a silver dollar would have been worth more than $1 in currency, and as a result, it could have been advantageous to melt silver dollars for their silver content, thereby decreasing the amount of circulating coinage. Similarly, if the silver price rose above $1.38 per ounce, the silver in dimes, quarters, and half-dollars would have been worth more than the coins' face value. To avoid a possible meltdown of the circulating coinage, the Treasury attempted to control the silver price through increased silver sales and increased minting operations from 1964 to 1967. A reduced silver content half-dollar, along with silverless dimes and quarters, were introduced in 1965 to help maintain the supply of circulating coinage, and in 1967, the Treasury announced that all silver coins were being withdrawn from circulation.

Silver occurs as native metal, but is usually found combined with sulfur. Until the 16th century, the ratio of silver to gold produced in Europe was about 10:1. Most of the silver was obtained from the lead sulfide ore galena. With the discovery and exploitation in the 16th and 17th centuries of silver deposits in the Americas, silver production shifted away from Europe. As production increased in Bolivia, Mexico, and Peru, the world ratio of silver to gold production increased because silver was relatively more abundant than gold in the New

World. Following the 1859 discovery of the Comstock Lode in Nevada, the United States was the world's leading silver producer from 1871 to about 1900. Mexico was the leading producer from 1900 to 1968, yielding to Canada from 1968 to 1976. In 1976, Mexico regained the position of the world's leading silver producer, a position that it held through 1991.

Definitions, Grades, and Specifications

The purity of silver in bullion, coinage, jewelry, or other items is usually expressed by its "fineness," or parts per thousand. Pure, or "fine," silver is 1,000 parts fine or 100.0% silver. Sterling silver is 925 fine, or 925 parts (92.5%) silver and 75 parts (7.5%) copper. Domestic coin silver is an alloy that was used in minting coinage until 1964 and contained 900 parts silver and 100 parts copper. Commercial silver bullion ranges from 999 to 999.9 fine. For any fineness of silver bullion, the principal impurities are gold or copper. Doré silver is unrefined silver bullion generally containing a variable percentage of gold as an impurity. Silver for the NDS is required to be 999 fine; free of slag, dirt, or other foreign material; and in bars weighing approximately 31 kilograms.

Uses and Products for Trade and Industry

The most important use of silver is in photographic materials. Silver is used in the manufacture of film, photographic paper, photocopying paper, X-ray film, photo-offset printing plates, and in some other minor light-sensitive products. Photographic materials are produced by depositing thin layers of silver salts, gelatin, and dyes onto a support material. Silver salts, although not extremely sensitive to light when first exposed to illumination, produce a greatly intensified image when subsequently treated with photographic chemical developers. The developer reduces a portion of each silver salt grain to metallic silver, depending on the intensity of the light to which the grain was exposed. The resulting gray to black metallic silver forms a negative image of the original object.

Silver is used in electrical and electronic products because of its high electrical and thermal conductivity and its resistance to corrosion. Silver has the highest thermal and electrical conductivities of any metal. Silver, in general, can be characterized as strongly resistant to atmospheric and ordinary oxidation and exceptionally resistant to corrosion by weak acids. Although silver commonly reacts with sulfur-containing atmospheric gases to form a sulfide tarnish, the tarnish itself offers little electrical resistance and does not prevent the use of silver as an electrical contact material. Pure silver is generally used in low- and medium-current switching devices. In other applications where the device requires higher strength, more wear resistance, better resistance to arcing, or lower costs, silver is usually alloyed with another metal such as copper or palladium to produce the desired characteristics.

Batteries constitute another electrical use for silver. Silver batteries produce a high-energy output per unit size and weight, but are generally characterized by a short life and high per unit cost. Primarily because of the short life and high costs, the use of silver batteries has been confined to defense and space applications where battery weight, size, and reliability are major concerns. There is, however, a growing use for small silver-zinc button cells in such commercial applications as calculators and hearing aids.

The use of silver for decorative purposes can be divided into three main applications. Probably the oldest use of silver is its use in jewelry. Silver or a silver alloy, usually silver and copper, is flattened and shaped into objects that can be worn for personal adornment. Sterlingware, the second decorative use, consists of articles such as bowls and flatware that are often functional as well as decorative. Sterling silver is an alloy of silver (92.5%) and copper (7.5%). The third decorative use for silver is electroplated ware. Electroplated ware generally consists of the same types of objects produced as sterlingware, the difference being that electroplated ware is made by depositing a thin silver layer on a base metal object, whereas the sterlingware object is formed entirely of the silver-copper alloy. Because less silver is used in a piece of electroplated ware than is used in a similar piece of sterlingware, the price of the plated piece is less than the price of a corresponding sterlingware piece.

The refrigeration and air-conditioning industry uses silver in the form of brazing alloys because of the ability of silver brazing alloys to wet various base metals at temperatures below their melting points. In general, silver brazing alloys do not dissolve or attack steel in normal usage, are ductile, maintain their strength over a wide range of temperatures, and will join a variety of materials. Silver is added to some solders to improve their flow properties, corrosion resistance, and wettability.

Silver is also used in mirrors, catalysts, medicinals, dental amalgams, bearings, coins, medallions, and a variety of commemorative objects. Silver is used in mirrors because of its high reflectivity in the visible portion of the spectrum. Silver catalysts are used in oxidation reactions such as the production of formaldehyde from methanol and the conversion of ethylene to ethylene oxide. Medicinal compounds include the soluble salts, such as the nitrates and citrates, and insoluble compounds such as the oxides, halides, and proteinates. In dentistry, silver is an important component of amalgam fillings.

Refined silver is available in the form of bars, grain, sheet, strip and foil, wire, rod and tubing, powder, and flake. Bars produced at refineries generally weigh about 31 kilograms and are about 30.5 centimeters long by 12.7 centimeters wide and 10.2 centimeters thick. Grain silver is produced by pouring molten silver into water, creating irregularly shaped silver particles less than 1.3 centimeters across. Silver sheet and foil are available in widths of up to almost 2.1 meters and as thin as 0.01 millimeter. Generally, the thinner the sheet or foil, the narrower it

is in width. Silver rod and wire can range from 5 centimeters in diameter to 0.1 millimeter in diameter. Openings in silver tubing can range from capillary size through 15 centimeters in diameter. Silver powders are generally powder-size (0.5 to 2 micrometers) spherical particles, although coarsersized particles can be produced.

Geology-Resources

About two-thirds of the world silver reserves and resources is contained in copper, lead, and zinc deposits. Ores in which silver or gold is the main component account for the remaining one-third of total world reserves and resources. U.S. silver resources are estimated to be about 190,000 tons.[1] Total world silver resources are estimated to be about 780,000 tons.

The chief silver minerals found in U.S. reserves are native silver (Ag), argentite (Ag_2S), cerargyrite (AgC1), polybasite ($Ag_{16}Sb_2S_{11}$), proustite (Ag_3AsS_3), pyrargyrite (Ag_3SbS_4) and tetrahedrite ($Cu_3(Sb, As)S_3$). Other ore minerals of silver are the tellurides, stromeyerite, and pearceite.

U.S. silver reserves are usually found associated with intermediate felsic rocks such as andesites and rhyolites, in veins ranging from a few centimeters to several meters in width. Ores from which silver is produced as a byproduct are usually found in copper porphyries, massive sulfide deposits, or in copper-lead-zinc vein deposits. Historically, most of the U.S. silver production has been from the Rocky Mountain States. It is likely that if major new reserves are discovered, the deposits will be in this region.

Technology

Mining.—Silver is mined using well-established open pit and underground methods. Open pit mining consists of removing overburden, drilling and blasting the exposed ore, loading the broken ore, and hauling the ore to the processing plant. Overburden removal is done with draglines or bulldozers, depending on the depth of the ore body. The broken ore is loaded by either power shovels or front-end loaders, and the ore is shipped to the processing plant by truck, train, conveyor belt, or some combination of these transport modes, depending on the distance to the plant.

Underground mining of silver is generally done using one of several stope mining methods. Stope mining consists of the development of a series of horizontal workings, or stopes, into the ore body from a shaft or tunnel. The stopes are above each other and can be vertically separated by as much as 60 meters of ore. The ore between the stopes is removed through the use of explosives.

Beneficiation.—Current treatment of silver-containing base metal ores is almost entirely by a flotation process. The concentrates contain the silver along with the copper, lead, and zinc. The silver is recovered from intermediate products resulting from smelting the concentrates. In predominantly lead ores, silver is carried down with the lead in smelting and separated from it by the addition of zinc to the molten silver-lead mixture. The mixture is allowed to cool, and the virtually insoluble silver-zinc alloy separates from the molten lead and rises to the surface where it is skimmed. In addition to the silver, this first crust contains some lead and any gold contained in the original ore. The zinc is distilled in a retort for reuse. The retort residue is roasted to recover the gold and silver as doré metal and the lead as litharge.

In predominantly copper ores, the silver is carried down with the copper in smelting. In the electrolytic refining of copper, the silver accumulates in the anode slime, from which it is recovered as silver bullion by smelting.

Gold and silver ores are generally treated by cyanidation. The ores are crushed by grinding in rod or ball mills and then leached with a dilute cyanide solution. Zinc dust is used to precipitate the gold and silver from the cyanide solution. The precipitate is melted in a furnace to produce a doré metal.

Silver bullion is generally refined using an electrolytic process. In the process, electricity is applied to a standard electrolytic cell in which the impure silver bullion is used as the anode, silver nitrate and nitric acid is used as the electrolyte, and either a pure silver strip or graphite is used as the cathode. Passage of an electrical current results in dissolution of silver in the anode and its subsequent deposition as silver crystals on the cathode. The silver crystals are periodically stripped from the cathode and collected, melted, and cast into bullion bars.

Economic Factors

Costs of mining silver ores vary greatly with depth, ground control problems, ventilation, width of vein, continuity of ore bodies, location, presence of byproduct metals, and the availability of electricity, water, labor, and equipment. Low-grade deposits can usually be mined profitably if sufficient quantities of other metals are contained in the ore. Accurate information on capital costs is difficult to obtain, not only because of variability in the factors enumerated above, but because of differences in accounting methods and definitions used by the mining industry. In general, the cost of mining silver ranges from less than about $30 per kilogram ($1.00 per troy ounce) to more than $260 per kilogram ($8.00 per troy ounce). Underground mining is, in general, more expensive than surface mining.

U.S. tax laws permit silver-producing companies a depletion allowance of 15% for domestic operations and 14% for foreign operations. There are no tariffs on the importation of silver ores, concentrates, doré, scrap, or refined bullion. Tariffs on semimanufactured silver can be as high as 27.5% ad valorem for countries receiving most-favored-nation classification and can be as high as 110% ad valorem for imports from those countries classified as non-most-favored nation, depending on the item.

Operating Factors

Silver mining is, in general, no more hazardous than other mining, but because of the depths reached in the Coeur d'Alene district, rock bursts there are relatively common. Temperatures are uncomfortable at these depths, and air conditioning must be used in ventilation systems. Gains in productivity are difficult to achieve because the possibilities for mechanization are limited by the relatively narrow veins mined. In recent years, companies have attempted to increase productivity through modification of labor agreements to allow more flexibility in work assignments and compensation and by improved mining plans.

Although in most circumstances silver is not a toxic substance in other than very large doses, a standard has been established for worker exposure to airborne particulate silver. The Occupational Safety and Health Administration currently requires that the concentration of either silver metal or soluble silver compounds be less than 0.01 milligram per cubic meter of ambient air in workplaces.

Nearly all silver-bearing ores are processed after grinding by flotation or cyanidation. Pollution of downstream waters by fine solids from flotation plants is a problem that requires adequate ponding and retention of tailings. Disposal or stabilization of the accumulated tailings can be a problem at some mines. It can be partially solved in those deep mines where ground support is needed by pumping the tailings back into the mine. In cyanidation operations, extreme care must be exercised to avoid contamination of the ground water, nearby watercourses, or surrounding areas through losses of leach solution. As a result, the solution collection system for returning the leachant to the storage tanks and the system for monitoring water in the surrounding area must be adequate to prevent pollution.

Achieving adequate air pollution (sulfur dioxide) control and disposing of slag and other wastes (iron and silica) are the problems encountered in smelting silver ores. Refining presents little environmental concern because the bulk of noxious impurities are removed during the smelting step; however, spent solutions from electrolytic refining present a disposal problem because of toxic materials in the solutions.

ANNUAL REVIEW

Legislation and Government Programs

The Bureau of the Mint produced three commemorative coins during the year. Public Law 101-332 authorized the production of gold, silver, and copper-nickel-clad coins in honor of the 50th anniversary of the Mount Rushmore National Memorial. Public Law 101-404 authorized the production of silver coins to commemorate the 50th anniversary of the United Services Organization (USO). Public Law 101-495 authorized the minting of a silver coin to commemorate the 38th anniversary of the ending of the Korean War.

All three silver commemorative coins had the same specifications. Each coin was made from a 90% silver-10% copper alloy, weighed 26.73 grams, and had a diameter of 3.8 centimeters. Inscribed on each coin was its face value ($1.00) and the words "Liberty," "In God We Trust," "United States of America," and "E Pluribus Unum." Also included on the Mount Rushmore and USO commemorative coins was the year of production (1991). Inscribed on the Korean War coin though, was the time period, 1953-1991. All three coins were legal tender. The NDS was the source of the silver used to manufacture the three coins. The enabling legislation limited the number of coins to be issued to 2 million for the Mount Rushmore commemorative coin and 1 million each for the USO and Korean War coins.

Included in the sales price of each coin was its face value and the labor, materials, dies, machinery, and various expenses, including overhead, marketing, and shipping required to design and issue the coins. Also added to the price of each coin was a $7.00 surcharge. Surcharges collected from the sale of the Mount Rushmore coins were divided, with one-half used to reduce the National debt and one-half given to the Mount Rushmore National Memorial Society to improve, enlarge, and renovate the Mount Rushmore National Memorial. One-half of the surcharges collected from sales of USO coins went to reduction of the National debt and one-half to the USO to fund its various programs. The Korean War Veterans Memorial Fund received all the surcharges collected from sales of the Korean War commemorative coins. The fund was to provide for the construction and maintenance of a Korean War Veterans Memorial in Washington DC.

Production

Silver was produced from precious-metal ores at 120 lode mines and from base metal ores at 21 lode mines. Silver was also produced at eight placer operations. In 1991, 17 mines each produced more than 30 tons of silver: their aggregated production equaled 75% of total domestic production.

In October, Magma Copper Co. signed an innovative labor agreement with its unions. The new agreement conditionally covered a 15-year period and prohibited strikes and lockouts for at least 7 years. Hourly workers were to receive wage increases of $0.25 to $0.35 per hour during the first 5 years of the agreement, with some increases tied to company earnings. After the initial 5-year period, the agreement would continue in force for another 10 years unless either party proposed to modify it. If the company and the unions could not agree on the proposed modifications, then the suggested modifications would be submitted to arbitration. After the initial 5 years, the use of arbitration twice in any subsequent 5-year period would terminate the contract. The termination would occur on the anniversary of the second arbitration award.

Alaska.—During the year, workers at the Greens Creek Mine mined and processed about 390,000 tons of ore and recovered almost 242 tons of silver.[2] As

in the previous year, reserves at the mine increased significantly. At yearend 1991, Greens Creek's estimated proven and probable reserves were about 12,560,000 tons grading 414 grams of silver per ton.

Performance improved at the Red Dog Mine following some mill modifications and as workers gained a better understanding of the various ore types. The operation processed almost 1,451,000 metric tons of ore in 1991 compared with 904,000 tons during the mine's first full year of operation. Average silver content of the ore was 87 grams per ton.[3] The company solved an unanticipated mine drainage problem during the year. Although the natural drainage at Red Dog was acidic and contained high metal levels, mining operations at the site reportedly aggravated the situation. To solve the problem, Cominco spent U.S.$14.0 million to divert the major water course in the area around the pit. The company also began to treat contaminated water generated in the pit and divert it to the tailings pond.

Arizona.—Magma Copper purchased the McCabe Mine during the year. The underground mine produced about 523 kilograms of silver and 121 kilograms of gold.[4]

In July, Magma signed a Memorandum of Commitment with its unions. The memorandum identified various processes first used at the San Manuel Mine that resulted in significant productivity gains and cost reductions. Included in the memo was the formation of high-performance teams. The teams, encouraged to suggest and implement more efficient production techniques, operated with greater autonomy and less supervision than previously. Magma planned to introduce these processes throughout its underground operations.

Idaho.—In early April, ASARCO Incorporated, operator and 50% holder of the Coeur Mine, temporarily ceased operations at the mine. Company officials, citing low silver prices for the decision, placed the mine on a care-and-maintenance basis. Reportedly, exploration to locate new ore reserves was to continue. On December 31, Coeur d'Alene Mines Corp. acquired Callahan Mining Corp. With the acquisition, Coeur's interest in the Coeur Mine increased from 45% to 50%. In 1991, Asarco milled about 34,000 tons of ore and recovered 12 tons of silver at the Coeur Mine. The previous year's production was 16 tons of silver.[5]

At its DeLamar Mine, NERCO Minerals Co. began a two-phase program to detoxify the mine's tailings pond. The company undertook the program, at least in part, in response to a bird mortality problem at the mine. The company planned to lower the cyanide concentration of the pond by injecting it with hydrogen peroxide which would destroy the residual cyanide. Additionally, the company planned to construct a cyanide recovery facility to remove the cyanide from the tailings before their deposition in the pond. The DeLamar Mine produced 1 ton of gold and 53 tons of silver during the year.[6]

With its acquisition of Callahan Mining, Coeur d'Alene Mines obtained a 50% nonoperating interest in the Galena Mine. Asarco, the mine's operator, milled about 166,000 tons of ore during 1991 and recovered 102 tons of silver.[7]

Near the end of June, Hecla Mining Co. acquired CoCa Mines Inc. CoCa's major asset was the Grouse Creek project, a gold-silver deposit in southern Idaho. With the acquisition of Grouse Creek, Hecla increased its reserves significantly. Hecla announced plans to proceed with development of the project, and production could begin by late 1993. At yearend 1991, reserves at the Grouse Creek project were 13,600,000 tons grading 1.5 grams per ton gold and 37.3 grams per ton silver.[8]

Cost reductions continued to benefit the Lucky Friday Mine. Despite operating at a loss, production continued throughout the year. Hecla, which owns and operates the mine, cited the continuing productivity improvements in the decision to keep the mine open. Corporate officials stated that because of the improvements the mine was now among the lowest cost domestic primary silver producers. According to the literature, the reduced operating costs have made it less costly to keep the mine operating than to place it on care and maintenace. For the year, the Lucky Friday Mine produced 58 tons of silver from 138,000 tons of ore.[9]

MinVen Gold Corp. acquired the 50% interest held by its joint-venture partner in the Stibnite Mine. MinVen took over operation of the mine in April. Production at the heap-leach operation reportedly improved following the resumption of crushing the ore before leaching.

In early June, Sunshine Precious Metals Inc. reduced the operating rate at the Sunshine Mine from 162 tons per year to about 81 tons per year as a consequence of the low silver price and the need to preserve cash. The new operating plan reportedly was less expensive than either full operation or placing the mine on care and maintenance. Company officials stated that the new plan would allow the mine to respond quickly to rising prices. In early July, the company negotiated new labor agreements covering most of the unionized workers at the Sunshine Mine. The new agreements cover a 3-year period, and were not expected to result in any significant increase in labor costs. Sunshine Precious Metals was a wholly owned subsidiary of the Sunshine Mining Co., whose major asset was the Sunshine Mine, mill, and refinery. During 1991, the Sunshine Mine produced 115 tons of silver.[10]

During the year, Hecla Mining Co. mined the remaining oxide ore at the Yellow Pine Mine. The heap-leach operation produced 255 kilograms of silver in 1991.[11] The Yellow Pine Mine won the State of Idaho's "Excellence in Operation Award" for its environmental work. Corporate officials expected leaching at the site to be completed in 1992.

Montana.—Unseasonably heavy precipitation hindered operations at the Beal Mountain Mine during the first half of 1991. The rains inhibited crusher

operation and diluted the mine's leach solutions, thereby reducing gold and silver production. Increased production during the second half made up most of the first half production shortfall. To guard against a recurrence, Pegasus Gold Inc. doubled the mine's solution treatment capacity by installing five new carbon columns in the plant. During 1991, Beal Mountain recovered 1,472 kilograms of gold and 243 kilograms of silver.[12]

Canyon Resources Corp. mined approximately 1,362,000 tons of ore at its Kendall Mine. The Kendall Mine, an open pit, heap-leach operation produced about 2 tons of gold and 333 kilograms of silver.[13]

Near mid-June, Pegasus took over mining at its Montana Tunnels Mine. Prior to that time, a contractor mined the deposit and Pegasus ran the processing plant. By performing the mining itself, Pegasus expected to realize a significant reduction in its operating costs. During the year, Montana Tunnels mined 3,875,000 tons of ore and recovered 2 tons of gold and 36 tons of silver.[14]

As with its Montana Tunnels Mine, Pegasus also took over the mining operations at its Zortman-Landusky Mine. The transition to in-house mining began in October. For 1991, the Zortman-Landusky Mine recovered 4 tons of gold and 30 tons of silver.[15]

Nevada.—At its Battle Mountain Complex, Battle Mountain Gold Co. recovered approximately 8 tons of gold and 13 tons of silver from the Fortitude, Labrador, and Surprise deposits.[16] The 1991 output of gold and silver was slightly lower than that for the previous year and probably was attributable to lower ore grades. The company processed more than 1 million tons of ore through its on-site carbon-in-pulp mill and leached an additional 660,000 tons. The Fortitude deposit probably will be depleted in early 1993, but Battle Mountain expects to develop other small, nearby deposits.

Cominco American Inc. halted mining at the Buckhorn Mine in May and crushing operations in June owing to ore depletion. Leaching was believed likely to continue into 1992. The company began site reclamation during the year and expected to complete its reclamation work in 1992.

In June, workers at the Bullfrog Mine began driving a drift into the North Zone reserves. The mine expected to begin underground production in 1992 using a drift-and-fill mining method. In 1991, the open pit mine produced 6 tons of silver.[17]

Although mining ceased at the Candelaria Mine in November 1990, continued leaching resulted in the production of almost 53 tons of silver and 93 kilograms of gold.[18] NERCO Minerals Co., operator of the Candelaria Mine, was proceeding with development of smaller gold deposits near the mine site.

Silver production at the McCoy-Cove Mine increased significantly. The mine consisted of two deposits, with production from two pits and two underground operations. In 1991, the mine produced 175 tons of silver, compared with 62 tons during the previous year.[19] Gold production also increased slightly. Company reports attributed the increases to several developments. One was a new effluent treatment plant completed in 1990. During that year, the company had been forced to reduce the concentration of chemicals used in the mill to help neutralize the mill effluent. With completion of the effluent treatment plant, the mill resumed the use of concentrated chemicals, and gold and silver recovery improved. Another factor for the significant jump in silver production was the increased mining of the Cove deposit. The Cove deposit contained significant quantities of silver, while the McCoy deposit contained only minor amounts. Also cited were increases in the underground mining rates and reduced waterflows in the Cove pit owing to the pit dewatering program. In early 1991, mining depleted the known ore reserves in the bottom of the McCoy pit. Exploration subsequently discovered some additional reserves. These additional reserves probably will be exploited following completion of underground mining in the deposit.

At the Paradise Peak Mine, silver production declined significantly. Gold production was about 6 tons and silver production about 72 tons.[20] In 1990, the mine produced 6 tons of gold and 170 tons of silver. Declining ore grades and the depletion of the high silver portion of the Paradise Peak deposit during 1990 were the primary factors in the lower production. To help offset the effects of the declining grades, FMC Gold Co. increased mill throughput at the mine and expanded its heap-leaching activities. The company milled approximately 1.4 million tons of ore and added about 2.9 million tons to the leach pads. The previous year, the company had milled 1.3 million tons and leached about 700,000 tons. During the second half, the company began mining operations at the County Line deposit. Previously, production had been from the original Paradise Peak and Ketchup Flat deposits. FMC began a gain-sharing program aimed at reducing operating costs. Savings from the program were expected to be about $1.3 million per year.

The Rawhide Mine completed its first full year of operation. The mine, owned and operated by Kennecott Corp., a wholly owned subsidiary of The RTZ Corp. PLC, produced gold and silver.

Magma Copper expanded its property holdings near the Robinson Mine. Among the properties acquired was the Taylor Mine, a former gold-silver producer. NERCO Minerals Co., which owned the Taylor Mine, exchanged its interest in the property for a net smelter royalty on the Robinson copper-gold property. Although the Taylor Mine had been inactive since 1984, the mine's mill had operated since then. Company officials expected the mine to produce copper, gold, and silver. Permitting and various studies were underway at yearend. In 1991, mining near-surface deposits on the Robinson property reportedly resulted in the production of 645 kilograms of gold.[21]

Gold and silver production at the Rochester Mine increased in 1991. Mining operations produced about 6.3 million tons of ore, and silver recovery at the heap-leach operation rose from 149 tons to 178 tons.[22] Gold production

increased slightly. Company officials attributed the increased production to the adoption of a new extraction technique called "counter-current leaching." This technique consisted of using the same batch solution to leach the ore on more than one leach pad. After passing through several heaps before processing the pregnant solution contained additional gold and silver. Reportedly, counter-current leaching reduces the volume of solution that must be processed by increasing the concentration of gold and silver in the pregnant solution.

Production at the Sleeper Mine declined, owing in part to a decline in ore grades. To help offset the lower ore grades, Amax Gold Inc. added a larger grinding mill to the operation, thereby increasing its mill capacity to about 2,000 tons per day. The increased capacity will allow the company to mill some lower grade ore previously heap leached, resulting in improved recoveries. For the year, the Sleeper Mine milled 565,000 tons of ore and added 7.5 million tons of ore to its leaching pads. Production at the mine included 9 tons of silver and 6 tons of gold.[23]

At the Wind Mountain Mine, Amax Gold Inc. mined about 13 million tons of ore. The heap-leach operation produced 13 tons of silver and 3 tons of gold.[24] Mining ceased at the open pit mine near the end of January 1992 owing to the depletion of ore reserves. Reclamation of the site began after that, although leaching continued.

Other States.—Mining resumed in the Cripple Creek mining district in Colorado. Pikes Peak Mining Co. began mining in the Globe Hill area of the district in June. Pikes Peak was a wholly owned subsidiary of NERCO Minerals. With the resumption of mining by Pikes Peak, NERCO Minerals reopened its Victor Mine. The Victor Mine, also in the Cripple Creek district, last produced in January 1986.

Production began at the San Luis Mine in July. The mine, near the town of San Luis, CO, was a typical open pit operation. The mine used a carbon-in-pulp leach circuit to process approximately 674,000 tons of ore. Although experiencing some startup problems, the mine produced 684 kilograms of gold and 435 kilograms of silver.[25]

Prior to its acquisition by Coeur d'Alene Mines Corp., Callahan Mining decided to abandon its Ropes Mine, near Ishpeming, MI. The Ropes Mine was an underground operation that produced gold and silver and had a history of ground control problems. Ground control problems near the mine's main shaft, along with low gold and silver prices, resulted in its closure in late September 1989. The mine never reopened. Company officials cited the continually escalating costs of reopening the mine and the continuing low gold prices when announcing their decision.

The Magmont Mine in Missouri reduced its work force by 20% to 151 employees during the year. Company officials cited lower metal prices and the need to remain competitive for the decision. Despite the reduced work force, the mine maintained its production levels and milled more than 1 million tons of ore.

At its copper refinery in El Paso, TX, Phelps Dodge Corp. recovered 60 tons of byproduct silver.[26] Feed material for the El Paso refinery came from its copper mines and smelters in Arizona and New Mexico and the Santa Gertrudis Mine, in Mexico. At the Morenci Mine in Arizona, Phelps Dodge mined about 40.4 million tons of ore. At its Chino and Tyrone Mines in New Mexico, the company mined about 16.4 million and 14.3 million tons of ore, respectively.

In Utah, gold and silver production at the Bingham Canyon Mine increased owing in part to an increase in mill throughput and to higher ore grades. The ore mined at Bingham Canyon reportedly contained about 112 tons of silver.[27]

Consumption and Uses

Apparent U.S. demand for silver in 1991, calculated as refinery production from primary materials and from old scrap plus net imports of refined bullion, was 3,846 tons. Included in the apparent demand calculation was the amount of silver absorbed by investors and the amount of silver required by the domestic fabricating industry. For the second consecutive year, apparent demand decreased, reflecting the continued lack of investor demand and the effects of the domestic recession.

Near mid-1992, the Silver Institute published estimates of silver consumption in 1991 by end use.[28] CPM Group, private consultants, developed the estimates for the Silver Institute. These estimates are reproduced in table 9. According to CPM, domestic silver consumption in 1991 declined from that of the previous year. Probably a major reason for the lower consumption was the economic recession.

Stocks

Total accountable stocks at yearend 1991 had increased by about 79 tons over those of yearend 1990. Continued buildup of stocks held by futures exchanges combined with an increase in industry-held stocks more than compensated for decline in Government-held stocks. Analysts cited the slowdown in the domestic economy and the lack of investor demand as the primary reasons for the continued stock buildup.

The total quantity of Government-held silver continued to decline. The U.S. Mint, as authorized by Congress, used NDS silver for various coinage programs. (See the "Legislation and Government Programs" section of this report.) Since 1985, Government-held stocks have declined by more than 1,600 tons. Various Government coinage programs have consumed nearly all the silver represented by the decrease.

Markets and Prices

The domestic silver price, as quoted by Handy & Harman, declined for the fourth consecutive year despite the lower domestic mine production and the lower quantity of silver recovered from old scrap. Analysts attributed the continued weak price primarily to lower industrial demand, combined with lack of investor

demand. The price began the year at $4.13 per troy ounce and generally trended downward until the end of February. The low for the year of $3.58 on February 26 was the lowest daily price since January 1974. Following the end of the Iraq-Kuwait conflict, the price rallied until it reached the high for the year, $4.53, near mid-June. Although the price subsequently declined, it remained near $4.00 per troy ounce for the remainder of the year. The London spot price followed a pattern similar to that of the Handy & Harman price. The U.S. dollar equivalent of the London spot price, as quoted in Metals Week, began 1991 at $4.16 per troy ounce and ended the year at $3.86. The low and high prices of $3.54 and $4.57 occurred on February 25 and June 10, respectively. The average for 1991 was $4.05.

The amount of silver represented by the future contracts traded on the Commodity Exchange Inc. (COMEX) increased in 1991 to 646,129 tons from 608,634 tons in 1990. At the Chicago Board of Trade, the quantity of silver corresponding to the futures trading volume decreased to 3,654 tons in 1991 from 5,912 tons in 1990. On the Mid-America Commodity Exchange, silver futures trading volume increase to 408 tons in 1991 from 342 tons in 1990.

Foreign Trade

U.S. silver exports decreased in 1991 for the first time in 7 years. The lower domestic mine production and the economic recession, both domestically and in other industralized countries, may have been contributing factors to the lower exports. The countries with the largest increases in quantities of silver imported from the United States were the United Kingdom and the United Arab Emirates. Shipments to these countries increased about 148 tons and 108 tons, respectively. Increased shipments of refined bullion accounted for the increased trade with both countries. The largest drop in U.S. silver exports were those to Japan, which decreased by 432 tons from those of the previous year. Cumulatively over the past 10 years, the United States has exported about 10,748 tons of silver. Japan (2,467 tons), Canada (2,397 tons), the United Kingdom (2,166 tons), and France (1,189 tons) have received most of the U.S. silver exports.

Although U.S. silver imports increased in 1991 for the fourth consecutive year, shipments from Canada and Mexico continued to decline. Canadian and Mexican exports to the United States fell by 230 tons and 205 tons, respectively, primarily the result of lower shipments of refined bullion. During the past 10 years, Canada has supplied 11,271 tons and Mexico 12,617 tons of the total U.S. imports of 38,166 tons during that period. The increased imports were due to increased exports by the United Kingdom (453 tons), Peru (204 tons), the Federal Republic of Germany (182 tons), Chile (169 tons), and Malaysia (152 tons).

World Review

The data in table 13 were rated production capacity in mines as of December 31, 1991. Rated capacity was defined as the maximum quantity of product that can be produced in a period of time on a normally sustainable, long-term operating rate, based on the physical equipment of the plant and given acceptable routine operating procedures involving labor, energy, materials, and maintenance. Capacity includes both operating plants and plants temporarily closed that, in the judgment of the author, can be brought into production within a short period of time with minimum capital expenditure.

As with U.S. consumption, the Silver Institute publication World Silver Survey 1992 contained estimates of world silver consumption. These estimates are reproduced in table 16.

Australia.—Completion of a project to push back the pit walls reduced the stripping ratio at the Pajingo Mine and provided access to deeper reserves. The mine milled 171,000 tons of ore and produced 2 tons of gold and 4 tons of silver.[29] Company officials stated that at current mining rates, the mine's known reserves would be depleted in 1992. The mill, however, would continue to process stockpiled ore through 1994. Battle Mountain let a contract to ACM Gold Ltd. for future exploration work near the Pajingo Mine.

Aberfoyle Ltd. closed the Que River Mine near yearend owing to exhaustion of the mine's reserves. The zinc-lead-silver operation mined almost 100,000 tons of ore containing an average 156 grams of silver per ton.[30]

Near mid-March, Niugini Mining Ltd. completed the purchase of the Red Dome Mine in Queensland. The open pit operation used heap leaching, flotation, and carbon-in-leach to recover gold, silver, and copper. In 1991, the mine produced about 1 ton of gold and 4 tons of silver.[31]

Bolivia.—In May, Battle Mountain increased its interest in Empresa Minera Inti Raymi S.A. to 85% from 51%. Battle Mountain acquired 24.5% of Inti Raymi's stock through the acquisition of Westworld Resources Inc. The company obtained the remainder of its share from Zeland Mines S.A. Inti Raymi operated the Kori Kollo heap-leach operation in Bolivia. The company began construction of a new carbon-in-pulp cyanide leach mill, which will be used to treat the sulfide portion of the deposit. In 1991, Kori Kollo recovered 2 tons of gold and 10 tons of silver.[32]

Canada.—MinVen Gold Corp. closed the Blackdome Mine following the exhaustion of known ore reserves in mid-January. The company reportedly sold some equipment at the mine and used the proceeds to help carry out reclamation of the site.

Completion of various projects during 1990 and 1991 increased the mill capacity of the Con Mine to 1,000 tons per day from about 700 tons per day. Nerco began installation of an autoclave during the year. The autoclave will be used to treat and stabilize arsenic sludge produced by the mine's former owners as a byproduct of their gold operations. Officials expected the autoclave to

recover some gold from the sludge and be operational by yearend 1992. The mine received an environmental award during the year for this cleanup effort.

Placer Dome Inc. reported the production of 175 tons of silver at the Equity Silver Mine in British Columbia.[33] In 1990, the mine had recovered 229 tons of silver. Company reports attributed the decline in production to the mining and processing of lower grade ores. Future silver production will continue to decline as the mine reaches the end of its planned life.

At its Kidd Creek Div., Falconbridge Ltd. reported the production of 168 tons of silver during 1991.[34] The byproduct silver production declined from that of the previous year owing in part to low zinc prices, which caused zinc production to decline. The company reduced both the number of employees in the division and the amount of contract labor used for capital projects as steps toward becoming a lower cost, more competitive operation.

Brunswick Mining and Smelting Corp. Ltd. settled a 10-month strike at its No. 12 Mine in early May. Through the strike, the company reportedly maintained operations at 25% of the normal levels with staff employees. During the year, the mine produced 127 tons of silver by milling 2,531,000 tons of ore.[35] Brunswick's smelter produced almost 51.3 tons of silver doré.

Kerr Addison Mines Ltd. closed its Opemiska Mine in June following exhaustion of its remaining reserves. For the year, the mine produced 4 tons of silver.[36] The silver production at Kerr's other operations was 9 tons from its Lac Dufault Div., 114 tons from its Samatosum Div., and 6 tons from its Winston Lake Div.

At the Sullivan Mine, Cominco Ltd. milled 1,688,300 tons of ore grading 39 grams of silver per ton, compared with 399,600 tons grading 28 grams of silver per ton the year before.[37] The company attributed the higher production primarily to essentially full year continous operations at the mine. During 1990, low zinc prices and high operating costs had resulted in the mine's closure from January to November. Also cited was the new labor agreement negotiated the previous year.

Highland Valley Copper Co. negotiated a new 2-year agreement with workers at its Valley Mine. The new agreement provided for wage and benefit improvements. During the year, the mine produced about 33 tons of silver contained in concentrate, compared with about 31 tons the previous year.[38]

Chile.—Production at the El Indio Complex declined, owing in part to a 26-day strike and the mining of lower grade ore. The El Indio Complex consisted of the El Indio and Tambo Mines. During the year, the operation milled about 982,000 tons of ore and leached 646,000 tons to recover 43 tons of silver.[39]

At the La Coipa Mine, a new processing plant began operating in October. The new plant had a capacity of 15,000 tons per day and could result in the mine producing more than 6 tons of gold and 500 tons of silver in 1992. The new plant, a conventional cyanide leaching gold and silver recovery plant, replaced an existing 1,000-ton-per-day mill. In 1991, La Coipa recovered 159 tons of silver.

Production began at the San Cristobal Mine in July. The mine was a typical open pit operation using heap leaching to recover gold and silver. Production during the year was lower than expected, owing in part to startup problems. Employees had corrected most of startup problems by yearend. For the year, the mine produced 653 kilograms of gold and almost 2 tons of silver.[40]

Mexico.—Silver production at the Real de Angeles Mine declined in 1991 to 263 tons of silver in response to lower ore grades and lower recoveries.[41] In response to low prices, Placer modified the mine's long-term mining plan to extract the highest grades available and postponed stripping activity.

Near midyear, operations commenced at the Santa Gertrudis Mine, a 2,000-ton-per-day heap-leach operation. Phelps Dodge had a 49% interest in the mine, with the remaider shared by a group of Mexican investors.

New Zealand.—The Golden Cross Mine began operations during the year. The initial doré pour occurred in December, and commercial production commenced in February 1992. Cyprus Minerals Co. has an 80% interest in the gold-silver operation.

Amax Gold increased its interest in the Waihi Mine from 28.35% to 33.53%. During the year, the open pit gold-silver mine milled 872,000 tons of ore, recovering 2 tons of gold and 11 tons of silver.[42]

Papua New Guinea.—Production at the Misima Mine increased despite the mining of lower grade material at the original deposit. The company was able to increase the average ore grade processed by blending the lower grade ore with higher grade material from the recently discovered Quartz Mountain zone. Increased mill throughput was an additional factor in the increased production. In 1991, the Misima Mine produced 80 tons of silver.[43]

At the Porgera Mine, workers completed construction of a pressure oxidation circuit in the third quarter. Production at the mine increased owing to higher mill throughputs and higher recoveries. Future production was believed likely to increase as the pressure oxidation circuit began treating stored tailings.

OUTLOOK

The dominant component of domestic silver supply is silver recovered as a byproduct of the processing of other nonferrous metals such as copper, gold, lead, and zinc. Most nonferrous ores contain some silver. Processing the ores concentrates the silver either in a waste stream or with the the principal product. Once concentrated, the additional cost to recover the silver is minimal.

Therefore, the quantity of silver supplied to the market is somewhat independent of the silver price. It is

likely that during the period 1992-94, domestic silver mine production will remain about 2,000 tons per year. Worldwide, mine production of silver should remain about 15,000 tons per year.

Future industrial demand for silver is harder to forecast owing to its many diverse uses. Over the next few years, the industrial demand for silver will likely follow the general economy, either upwards or downwards, but remain about 3,700 tons. Worldwide, silver demand will grow slightly with the gradual opening of new markets in lesser developed countries.

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[2]Hecla Mining Co. 1991 Annual Report, 66 pp.

[3]Cominco Ltd. 1991 Annual Report, 64 pp.

[4]Magma Copper Co. 1991 10K Report, 69 pp.

[5]Coeur d'Alene Mines Corp. 1991 10K Report, 53 pp.

[6]NERCO Inc. 1991 10K Report, 38 pp.

[7]Work cited in footnote 5.

[8]Work cited in footnote 2.

[9]Work cited in footnote 2.

[10]Sunshine Mining Co. 1991 Annual Report, 20 pp.

[11]Work cited in footnote 2.

[12]Pegasus Gold Inc. 1991 Annual Report, 48 pp.

[13]Canyon Resources Corp. 1991 Annual Report, 36 pp.

[14]Work cited in footnote 12.

[15]Work cited in footnote 12.

[16]Battle Mountain Gold Co. 1991 Annual Report, 56 pp.

[17]LAC Minerals Ltd. 1991 Annual Report, 70 pp.

[18]Work cited in footnote 6.

[19]Echo Bay Mine Ltd. 1991 10K Report, 115 pp.

[20]FMC Gold Co. 1991 Annual Report, 30 pp.

[21]Work cited in footnote 4.

[22]Work cited in footnote 5.

[23]Amax Gold Inc. 1991 10K Report, 80 pp.

[24]Work cited in footnote 23.

[25]Work cited in footnote 16.

[26]Phelps Dodge Corp. 1991 10K Report, 70 pp.

[27]The RTZ Corp. PLC 1991 Annual Report, 66 pp.

[28]The Silver Institute. World Silver Survey 1992, 113 pp. Available from the Silver Institute, 1112 Sixteenth St., NW, Suite 2401, Washington, DC 20036.

[29]Battle Mountain Gold Co. 1991 10K Report, 85 pp.

[30]Work cited in footnote 3.

[31]Work cited in footnote 29.

[32]Work cited in footnote 16.

[33]Placer Dome Inc. 1991 Annual Report, 60 pp.

[34]Noranda Inc. 1991 Annual Report, 57 pp.

[35]Brunswick Mining and Smelting Corp. Ltd. 1991 Annual Report, 28 pp.

[36]Kerr Addison Mines Ltd. 1991 Annual Report, 24 pp.

[37]Work cited in footnote 3.

[38]Work cited in footnote 3.

[39]Work cited in footnote 17.

[40]Work cited in footnote 29.

[41]Work cited in footnote 33.

[42]Amax Gold Inc. 1991 Annual Report, 48 pp.

[43]Work cited in footnote 33.

OTHER SOURCES OF INFORMATION

Bureau of Mines Publications

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Minerals Today, bimonthly.

Other Publications

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Engineering and Mining Journal, Chicago, IL.

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Metals Week, New York.

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The Northern Miner, Toronto, Canada.

The Silver Institute Letter, pub. bimonthly by the Silver Institute, Washington, DC.

The Silver Market, compiled by Handy & Harman, New York.

TABLE 1
SALIENT SILVER STATISTICS

		1987	1988	1989	1990	1991
United States:						
Mine production	metric tons	1,241	1,661	2,007	r2,125	1,848
Value	thousands	$277,063	$349,339	$354,971	r$329,329	$240,041
Refinery production:						
Domestic and foreign ores and concentrates	metric tons	1,415	1,474	1,718	r1,598	1,879
Secondary (old scrap)	do.	810	852	r714	r454	229
Exports:						
Refined	do.	350	444	430	736	787
Other	do.	493	555	850	1,112	894
Imports for consumption:						
Refined	do.	2,114	2,260	3,062	2,698	2,525
Other	do.	431	497	241	646	1,626
Stocks, Dec. 31:						
Industry	do.	471	480	544	r583	618
Futures exchanges	do.	5,279	5,862	7,795	8,636	8,755
Apparent demand, refined[1]	do.	3,989	4,142	r5,063	r4,014	3,846
Coinage	do.	469	275	r264	265	285
Price, average per troy ounce[2]		$7.01	$6.54	$5.50	$4.82	$4.04
Employment[3]		1,800	2,300	2,800	2,600	1,900
World:						
Mine production	metric tons	r14,019	r14,517	r15,057	r15,122	14,723
Consumption:[4]						
Industry and the arts	do.	15,443	16,671	r16,899	17,409	17,465
Coinage	do.	933	799	r1,141	799	840

rRevised. NA Not available.

[1]Defined as refinery production from primary materials plus refinery production from old scrap plus imports of bullion minus exports of bullion. Represents not only the quantity of silver required by the domestic fabricating industry, some of which may be placed in stocks, but also the quantity of silver demanded by U.S. investors.

[2]Metals Week Annual Handy & Harman quotation.

[3]Mine Safety and Health Administration.

[4]Silver Market 1991. Compiled by Handy & Harman.

TABLE 2

MINE PRODUCTION OF RECOVERABLE SILVER IN THE UNITED STATES, BY STATE

(Metric tons)

State	1987	1988	1989	1990	1991
Alaska	(1)	1	W	W	W
Arizona	114	152	171	173	148
California	4	15	21	21	W
Colorado	27	27	W	23	20
Idaho	W	340	439	r442	337
Missouri	37	45	53	r42	35
Montana	185	192	194	220	222
Nevada	379	608	625	r646	578
New Mexico	58	93	78	48	W
Oregon	W	W	W	W	—
South Dakota	W	3	4	r10	7
Utah	W	W	185	147	W
Other States[2]	436	185	239	354	484
Total[3]	1,241	1,661	2,007	r2,125	1,848

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Other States."
[1]Less than 1/2 unit.
[2]Includes Illinois, Kentucky, Michigan, New York, South Carolina, Tennessee, Washington, and States indicated by symbol "W."
[3]Data may not add to totals shown because of independent rounding.

TABLE 3

MINE PRODUCTION OF RECOVERABLE SILVER IN THE UNITED STATES, BY MONTH

(Metric tons)

Month	1987	1988	1989	1990	1991
January	99	116	143	r195	137
February	97	114	139	r169	134
March	105	131	166	r184	166
April	103	126	160	r174	164
May	99	129	176	r179	158
June	101	142	174	r180	145
July	110	142	175	r179	150
August	107	152	185	r184	160
September	109	152	179	r164	173
October	105	157	168	r175	159
November	100	150	170	r175	141
December	106	150	173	r164	158
Total[1]	1,241	1,661	2,007	r2,125	1,848

rRevised.
[1]Data may not add to totals shown because of independent rounding.

TABLE 4

TWENTY-FIVE LEADING SILVER-PRODUCING MINES IN THE UNITED STATES IN 1991, IN ORDER OF OUTPUT

Rank	Mine	County and State	Operator	Source of silver
1	Greens Creek	Admiralty Island, AK	Greens Creek Mining Co.	Zinc ore.
2	Rochester	Pershing, NV	Coeur Rochester Inc.	Silver ore.
3	McCoy and Cove	Lander, NV	Echo Bay Mining Co.	Gold ore.
4	Troy	Lincoln, MT	ASARCO Incorporated	Copper ore.
5	Bingham Canyon	Salt Lake, UT	Kennecott-Utah Copper Co.	Do.
6	Sunshine	Shoshone, ID	Sunshine Mining Co.	Silver ore
7	Galena	Do.	ASARCO Incorporated	Do.
8	Paradise Peak	Nye, NV	FMC Gold Co.	Gold ore.
9	Lucky Friday	Shoshone, ID	Hecla Mining Co.	Lead-zinc ore.
10	DeLamar	Owyhee, ID	NERCO DeLamar Co.	Gold ore.
11	Candelaria	Mineral, NV	NERCO Metals Inc.	Silver ore.
12	Red Dog	NW Arctic, AK	Cominco Alaska Inc.	Zinc ore.
13	Montana Tunnels	Jefferson, MT	Montana Tunnels Mining Inc.	Do.
14	Mission Complex[1]	Pima, AZ	ASARCO Incorporated	Copper ore.
15	White Pine	Ontonagon, MI	Copper Range Co.	Do.
16	Zortman-Landusky	Phillips, MT	Pegasus Gold Inc.	Gold ore.
17	Bagdad	Yavapai, AZ	Cyprus Bagdad Copper Co.	Copper ore.
18	Tyrone	Grant, NM	Phelps Dodge Corp.	Do.
19	Wind Mountain	Washoe, NV	Amax Gold Corp.	Gold ore.
20	Continental	Silver Bow, MT	Montana Resources Inc.	Copper ore.
21	Morenci	Greenlee, AZ	Phelps Dodge Corp.	Do.
22	Ray Unit	Pinal, AZ	ASARCO Incorporated	Do.
23	Denton-Rawhide	Mineral, NV	Kennecott Rawhide Mining Co.	Gold ore.
24	San Manuel	Pinal, AZ	Magma Copper Co.	Copper ore.
25	Coeur	Shoshone, ID	ASARCO Incorporated	Silver ore.

[1]Includes Eisenhower, Mission, Pima, and San Xavier Mines.

TABLE 5

SILVER PRODUCED IN THE UNITED STATES, BY STATE, TYPE OF MINE, AND CLASS OF ORE

Year and State	Placer (metric tons of silver)	Lode			
		Gold ore		Silver ore	
		Metric tons	Metric tons of silver	Metric tons	Metric tons of silver
1987	1	62,044,114	221	7,944,696	432
1988	(1)	108,310,781	372	9,573,505	674
1989	W	155,188,564	528	4,450,703	524
1990	W	186,690,461	r627	W	W
1991:					
Alaska	W	—	—	—	—
Arizona	—	1,360,973	W	—	—
California	(1)	17,918,664	15	—	—
Colorado	—	2,012,764	W	—	—
Idaho	—	1,132,792	W	W	W
Michigan	—	—	—	—	—
Missouri	—	—	—	—	—
Montana	—	W	W	—	—
Nevada	W	105,803,397	343	W	W
New Mexico	—	W	W	—	—
New York	—	—	—	—	—
South Carolina	—	W	W	—	—
South Dakota	W	5,727,349	7	—	—
Tennessee	—	—	—	—	—
Utah	—	4,639,301	15	—	—
Washington	—	W	W	—	—
Total	W	159,990,749	498	W	W
Percent of total silver	W	XX	27	XX	W

	Lode				Total[4]	
	Copper ore		Other[2 3]			
	Metric tons	Metric tons of silver	Metric tons	Metric tons of silver	Metric tons	Metric tons of silver
1987	201,434,248	477	W	W	r279,780,498	1,241
1988	222,306,768	485	W	W	r350,625,607	1,661
1989	230,558,434	529	W	W	r407,088,486	2,007
1990	240,620,259	492	W	W	445,497,037	r2,125
1991:						
Alaska	—	—	W	W	W	W
Arizona	W	W	W	W	169,227,050	148
California	W	W	—	—	W	W
Colorado	—	—	W	W	W	20
Idaho	—	—	W	W	1,616,531	337
Michigan	W	W	—	—	W	W
Missouri	—	—	6,403,832	35	6,403,832	35
Montana	W	W	W	W	39,215,732	222
Nevada	W	W	W	W	110,014,894	578
New Mexico	W	W	—	—	W	W
New York	—	—	W	W	W	W
South Carolina	—	—	—	—	W	W

See footnotes at end of table.

TABLE 5—CONTINUED

SILVER PRODUCED IN THE UNITED STATES

	Lode				Total[4]	
	Copper ore		Other[2 3]			
	Metric tons	Metric tons of silver	Metric tons	Metric tons of silver	Metric tons	Metric tons of silver
South Dakota	—	—	—	—	5,727,349	7
Tennessee	—	—	W	W	W	W
Utah	W	W	—	—	W	W
Washington	—	—	—	—	W	W
Total	261,389,296	480	W	W	439,660,399	1,848
Percent of total silver	XX	26	XX	W	XX	100

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Total," where applicable. XX Not applicable.
[1]Less than 1/2 unit.
[2]Includes lead, zinc, copper-lead, lead-zinc, copper-zinc, copper-lead-zinc ores, and old tailings, etc.
[3]Includes silver recovered from tungsten and fluorspar ores.
[4]Data may not add to totals shown because of independent rounding.

TABLE 6

SILVER PRODUCED IN THE UNITED STATES BY CYANIDATION[1]

Year	Leaching in vats, tanks, and closed containers[2 3]		Leaching in open heaps or dumps[4]	
	Ore treated (metric tons)	Silver recovered (metric tons)	Ore treated (metric tons)	Silver recovered (metric tons)
1987	r22,900,343	280	r45,256,274	254
1988	r26,593,821	302	r86,870,554	456
1989	r38,855,007	300	r119,199,347	490
1990	47,279,850	290	138,974,999	r498
1991	50,699,169	176	112,808,497	537

rRevised.
[1]May include small quantities recovered by leaching with thiourea, by bioextraction, and by proprietary processes.
[2]Including autoclaves.
[3]May include small quantities recovered by gravity methods.
[4]May include tailings and waste ore dumps.

TABLE 7

LODE SILVER PRODUCED IN THE UNITED STATES, BY STATE

Year and State	Amalgamation		Cyanidation		Smelting of concentrates			Smelting of ore		Total ore processed[1 2] (metric tons)	Total silver recovered[2] (metric tons)
	Ore treated (metric tons)	Silver recovered (metric tons)	Ore treated (metric tons)	Silver recovered (metric tons)	Ore concentrated (metric tons)	Concentrates smelted (metric tons)	Silver recovered (metric tons)	Ore smelted (metric tons)	Silver recovered (metric tons)		
1987	W	W	68,156,617	534	r211,446,971	4,459,843	696	W	W	r279,780,498	1,240
1988	1,512	[3]	113,464,375	758	r236,925,134	4,943,949	884	r239,195	19	r350,625,607	1,661
1989	W	W	158,054,354	790	r248,846,575	5,164,847	1,195	W	W	r407,088,486	2,007
1990	1,230	[3]	186,254,849	r788	r259,153,747	r6,214,949	W	87,210	W	445,497,037	r2,125
1991:											
Alaska	—	—	—	—	W	W	W	—	—	W	W
Arizona	—	—	1,350,509	[3]	167,860,487	2,757,629	145	13,866	3	169,227,050	148
California	—	—	17,918,665	15	W	W	W	—	—	17,918,665	W
Colorado	W	W	2,012,764	4	W	W	W	—	—	2,347,744	20
Idaho	—	—	1,132,792	W	483,739	W	279	—	—	1,616,531	337
Michigan	—	—	—	—	W	W	W	—	—	W	W
Missouri	—	—	—	—	6,403,832	531,533	35	—	—	6,403,832	35
Montana	W	W	W	W	22,588,939	251,984	189	—	—	39,215,732	222
Nevada	—	—	109,909,503	575	W	W	W	31,507	1	110,014,894	578
New Mexico	—	—	—	—	W	W	W	W	W	W	W
New York	—	—	—	—	W	W	W	—	—	W	W
South Carolina	—	—	W	W	—	—	—	—	—	W	W
South Dakota	—	—	5,727,349	7	—	—	—	—	—	5,727,349	7
Tennessee	—	—	—	—	W	W	W	—	—	W	W
Utah	—	—	4,602,462	9	W	W	W	W	W	W	W
Washington	—	—	W	W	488,763	24,774	8	—	—	W	W
Total	W	W	163,507,666	713	260,212,391	6,249,955	W	135,336	W	439,660,399	1,848

rRevised. W Withheld to avoid disclosing company proprietary data; included in "Total," where applicable.

[1]Includes old tailings and some nonsilver-bearing ores not separable, in amounts ranging from 0.04% to 0.12% of the totals for the years listed. Excludes fluorspar, molybdenum, and tungsten ores from which silver was recovered as a byproduct and excludes ores leached for recovery of copper.

[2]Data may not add to totals shown because of independent rounding.

[3]Less than 1/2 unit.

TABLE 8
U.S. REFINERY PRODUCTION OF SILVER

(Metric tons)

Raw material	1987	1988	1989	1990	1991
Concentrates and ores:					
Domestic and foreign	1,415	1,474	1,718	r1,598	1,879
Old scrap	810	852	r714	r454	229
New scrap	1,316	1,505	1,495	r1,221	1,634
Total[1]	3,541	3,832	r3,927	r3,274	3,743

rRevised.
[1]Data may not add to totals shown because of independent rounding.

TABLE 9
ANNUAL U.S. FABRICATION DEMAND

(Metric tons)

End use	1987	1988	1989	1990	1991
Photography	1,872	1,944	2,028	2,115	2,053
Electrical contacts and conductors	706	715	731	709	569
Batteries	75	78	87	93	96
Sterlingware	118	109	106	109	109
Jewelry	131	90	75	62	62
Silverplate	78	81	84	87	87
Brazing alloys and solders	174	—	—	—	—
Catalysts	75	81	87	93	103
Medallions and commemorative objects	131	—	—	—	—
Dental and medical supplies	40	44	53	56	—
Mirrors	31	34	34	37	34
Bearings	9	—	—	—	—
Miscellaneous[1]	140	389	448	535	579
Total industrial consumption[2]	3,586	3,484	3,732	3,891	3,692
Coinage	379	246	212	283	280
Grand total[2]	3,966	3,729	3,944	4,180	3,972

[1]Includes end uses marked with dashes.
[2]Data may not add to totals shown because of independent rounding.

Source: See footnote 28.

TABLE 10
YEAREND STOCKS OF SILVER IN THE UNITED STATES

(Metric tons)

	1987	1988	1989	1990	1991
Industry	471	480	544	r583	618
Futures exchanges	5,279	5,862	7,795	8,636	8,755
Department of the Treasury	1,229	1,201	997	840	1,028
Department of Defense	75	81	81	31	23
National Defense Stockpile	3,517	3,310	2,973	r2,866	2,611

rRevised.

TABLE 11
U.S. SILVER PRICES

(Dollars per troy ounce)

Period	Low		High		Average
	Price	Date	Price	Date	
1987	5.36	Jan. 7	10.20	Apr. 27	7.01
1988	6.01	Nov. 21 and Dec. 29	7.99	July 21	6.54
1989	5.02	Sept. 15	6.17	Jan. 23	5.50
1990	3.93	Dec. 18	5.39	Feb. 7	4.82
1991:					
January	3.79	Jan. 24 and 28	4.23	Jan. 7 and 15	4.02
February	3.58	Feb. 26	3.85	Feb. 4	3.72
March	3.73	Mar. 1	4.16	Mar. 8	3.96
April	3.87	Apr. 29	4.08	Apr. 3	3.97
May	3.95	May 1 and 2	4.15	May 28	4.04
June	4.15	June 5	4.53	June 10 and 11	4.39
July	4.02	July 30	4.49	July 10	4.30
August	3.82	Aug. 30	4.05	Aug. 1	3.94
September	3.87	Sept. 5	4.21	Sept. 24	4.03
October	4.06	Oct. 14 and 28	4.18	Oct. 2	4.10
November	4.01	Nov. 7 and 8	4.12	Nov. 25	4.06
December	3.82	Dec. 12 and 31	4.06	Dec. 6	3.91
Average and date	3.58	Feb. 26	4.53	June 10 and 11	4.04

Source: Metals Week Handy & Harman daily quotation.

TABLE 12

U.S. EXPORTS OF SILVER, BY COUNTRY[1]

Year and country	Ores and concentrates		Wastes and scrap		Doré and precipitates		Refined bullion		Total[2]	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
1987	472	$150	425,325	$96,738	67,286	$16,294	349,610	$79,123	842,693	$192,305
1988	25,450	1,416	475,481	99,797	53,733	10,844	443,831	94,029	998,495	206,086
1989	607	166	770,788	145,340	78,664	15,478	430,110	77,812	1,280,169	238,797
1990	21,861	3,994	1,077,421	159,194	13,184	2,353	735,993	119,892	1,848,458	285,434
1991:										
Austria	—	—	—	—	—	—	873	162	873	162
Belgium	—	—	150,696	21,422	—	—	—	—	150,696	21,422
Brazil	—	—	—	—	—	—	2,028	402	2,028	402
Canada	14	3	338,200	52,586	—	—	22,885	3,975	361,100	56,564
China	—	—	355	53	—	—	—	—	355	53
France	—	—	115,998	15,538	26,620	3,612	686	99	143,304	19,250
Germany, Federal Republic of	—	—	15,165	2,115	2,764	398	10,872	2,156	28,801	4,669
Hong Kong	—	—	3,152	755	—	—	23,481	3,244	26,633	3,998
Ireland	—	—	—	—	—	—	893	88	893	88
Israel	—	—	2,182	320	—	—	—	—	2,182	320
Italy	—	—	1,826	279	—	—	18	3	1,844	282
Japan	—	—	66,092	8,072	22,370	4,235	202,764	30,893	291,226	43,200
Korea, Republic of	27	5	4,687	766	—	—	87,806	14,658	92,519	15,428
Mexico	—	—	613	95	—	—	—	—	613	95
Netherlands	—	—	3,994	748	—	—	—	—	3,994	748
Singapore	—	—	—	—	—	—	49,551	6,672	49,551	6,672
Spain	—	—	15,814	2,200	10	6	41	7	15,866	2,213
Sweden	—	—	21,716	2,909	—	—	—	—	21,716	2,909
Switzerland	—	—	964	233	229	43	242	46	1,435	322
Taiwan	29	5	114	17	668	114	759	133	1,568	269
United Arab Emirates	—	—	—	—	—	—	107,683	14,240	107,683	14,240
United Kingdom	14	10	98,055	15,722	459	74	268,370	37,054	366,898	52,860
Uruguay	—	—	—	—	—	—	8,045	1,306	8,045	1,306
Other	145	26	603	185	6	4	477	87	1,232	302
Total[2]	229	49	840,229	124,015	53,128	8,486	787,474	115,224	1,681,058	247,774

[1]Because of the implementation of the Harmonized Tariff System in Jan. 1989, export data may not be comparable with previous years' data.
[2]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 13

U.S. IMPORTS OF SILVER, BY COUNTRY[1]

Year and country	Ores and concentrates		Wastes and scrap		Doré and precipitates		Refined bullion		Total[2]	
	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)	Quantity (kilograms)	Value (thousands)
1987	83,401	$18,019	105,881	$22,514	242,017	$53,858	2,113,765	$460,235	2,545,064	$554,627
1988	191,324	35,508	60,470	12,995	245,122	52,840	2,260,049	476,181	2,756,964	577,524
1989	7,013	2,301	90,753	96,254	142,739	27,943	3,061,548	578,781	3,302,054	705,278
1990	90,202	23,203	507,649	86,421	48,449	8,741	2,697,926	437,380	3,344,229	555,744
1991:										
Australia	—	—	2,234	12	—	—	—	—	2,234	12
Belgium	37	4	73,270	497	—	—	—	—	73,308	501
Brazil	—	—	2,721	15	—	—	22	7	2,743	22
Canada	12,553	2,340	91,170	16,939	16,301	2,528	789,683	102,903	909,708	124,710
Chile	—	—	383	60	15,043	4,494	206,537	33,038	221,962	37,591
Denmark	—	—	45,477	120	—	—	—	—	45,477	120
Dominican Republic	—	—	20,573	625	23,919	3,593	33	6	44,525	4,224
Germany, Federal Republic of	115	15	244,452	3,631	—	—	10,026	1,248	254,593	4,893
Malaysia	—	—	156,878	2,788	—	—	19,664	2,908	176,542	5,697
Mexico	8,614	1,283	1,031	2,560	61,914	9,511	1,071,439	142,346	1,142,998	155,699
Peru	—	—	—	—	30,623	4,887	427,606	56,034	458,228	60,921
Philippines	—	—	109,794	2,453	—	—	—	—	109,794	2,453
Singapore	—	—	9,919	161	—	—	—	—	9,919	161
South Africa, Republic of	—	—	86,594	46,585	—	—	—	—	86,594	46,585
Sweden	—	—	393	14,129	—	—	—	—	393	14,129
Switzerland	4	5	6,494	51,546	—	—	—	—	6,497	51,550
Taiwan	—	—	615	1,942	—	—	—	—	615	1,942
United Kingdom	—	—	599,540	5,613	—	—	—	—	599,540	5,613
Zaire	—	—	—	—	4,035	726	—	—	4,035	726
Other	100	13	963	3,622	1	1	124	24	1,187	3,662
Total[2]	21,422	3,659	1,452,501	153,299	151,836	25,740	2,525,133	338,514	4,150,893	521,212

[1]Because of the implementation of the Harmonized Tariff System in Jan. 1989, import data may not be comparable with previous years' data.
[2]Data may not add to totals shown because of independent rounding.

Source: Bureau of the Census.

TABLE 14

WORLD ANNUAL SILVER PRODUCTION CAPACITY,[1] DECEMBER 31, 1991

(Metric tons)

	Rated capacity
North America:	
Canada	1,380
Mexico	2,420
United States	2,130
Other	160
Total	6,090
South America:	
Chile	520
Peru	2,050
Other	420
Total	2,990
Europe:	
Poland	1,060
Spain	370
U.S.S.R.	1,500
Other	890
Total	3,820
Africa	750
Asia:	
Japan	360
Other	680
Total	1,040
Oceania:	
Australia	1,120
Other	70
Total	1,190
World total	15,880

[1]Includes capacity at operating plants as well asat plants on standby basis.

TABLE 15

SILVER: WORLD MINE PRODUCTION, BY COUNTRY[1]

(Kilograms)

Country[2]	1987	1988	1989	1990	1991[e]
Algeria[e]	3,750	3,750	3,000	2,800	2,500
Argentina	59,667	79,415	83,436	82,657	56,359
Australia	1,119,291	1,117,528	1,075,000	1,138,000	1,180,000
Bolivia	141,987	231,766	267,084	310,543	337,061
Brazil[4]	r110,400	124,061	172,117	223,052	225,000
Bulgaria[e]	r80,000	71,000	59,000	54,000	40,000
Burma	26,096	9,207	6,843	5,298	5,387
Canada (shipments)	1,374,992	1,443,166	1,262,163	1,399,572	1,400,000
Chile	499,761	506,501	545,412	654,603	660,000
China[e]	100,000	110,000	125,000	125,000	150,000
Colombia[5]	4,977	6,563	6,847	6,591	6,600
Costa Rica[e]	[6]62	[6]62	[6]194	[6]115	[6]100
Czechoslovakia[e]	30,000	30,000	30,000	25,000	20,000
Dominican Republic	35,707	39,595	22,614	21,630	21,955
Ecuador[e]	[6]60	[6]60	[6]60	[6]60	[6]60
Fiji	840	995	1,055	e800	700
Finland	44,198	31,411	31,127	r28,508	25,000
France	25,194	24,074	r20,600	r22,100	20,000
Germany, Federal Republic of:[e]					
Eastern states	r60,000	r60,000	r59,700	r20,000	NA
Western states	[3]30,890	r20,000	r9,000	r8,000	NA
Total	90,890	80,000	68,700	28,000	22,000
Ghana[e]	510	580	668	840	1,300
Greece[e]	[3]51,881	r61,000	60,000	62,000	60,000
Greenland	13,001	14,300	14,700	r9,600	—
Honduras	23,234	58,447	49,892	r18,788	20,000
India	37,946	40,958	35,499	r33,206	[3]31,758
Indonesia	50,485	61,538	r72,498	67,315	[3]80,294
Iran[e]	28,000	30,000	41,000	38,000	40,000
Ireland	7,185	5,598	7,247	e7,200	7,000
Italy[5 6]	82,031	91,563	96,036	r103,400	[3]178,400
Japan	281,020	251,971	155,792	149,920	[3]170,676
Korea, North[e]	49,800	49,800	50,000	50,000	50,000
Korea, Republic of[5]	209,058	226,687	239,214	238,236	235,000
Malaysia	15,797	10,775	13,007	12,558	[3]13,440
Mexico	2,414,954	2,358,907	2,306,091	2,346,336	[3]2,196,100
Morocco	e43,900	226,216	236,611	r [5]241,108	[3]200,000
Namibia	103,264	116,520	108,247	r e93,000	89,000
New Zealand	—	1,845	4,837	4,914	11,000
Nicaragua	888	776	1,113	1,095	[3]1,543
Papua New Guinea	61,066	70,408	93,672	e130,000	[3]124,880
Peru	2,054,448	1,551,598	r1,840,000	1,724,923	[3]1,769,743
Philippines	52,374	r54,634	r e50,630	r47,110	[3]38,414
Poland	830,992	1,062,993	1,003,000	r832,000	870,000
Portugal	746	877	20,115	r43,100	43,500
Romania[e]	20,000	23,000	26,000	r12,000	10,000
Saudi Arabia[e]	—	3,600	10,800	e [6]10,800	10,800

See footnotes at end of table.

TABLE 15—CONTINUED

SILVER: WORLD MINE PRODUCTION, BY COUNTRY[1]-CONTINUED

(Kilograms)

Country[2]	1987	1988	1989	1990	1991[e]
Solomon Islands	—	[6]8	[6]7	[e 6]5	[3 6]4
South Africa, Republic of	208,118	199,745	[r]179,829	[r]181,003	[3]171,554
Spain	350,008	353,034	[r e]530,000	[e]500,000	500,000
Sweden	254,107	207,804	227,715	[r]242,685	225,000
Taiwan	9,856	8,388	6,491	[e]6,000	—
Tunisia[e]	1,600	1,600	1,600	1,600	1,600
Turkey[e]	8,800	22,500	28,500	[r]33,300	38,800
U.S.S.R.[e 5]	1,510,000	1,520,000	1,520,000	1,400,000	1,300,000
United States	1,241,000	1,661,425	2,007,436	2,125,000	[3]1,848,000
Yugoslavia[5]	165,221	138,970	[r]127,412	[r]105,327	94,000
Zaire	36,767	74,000	[r e]70,000	[r e]84,000	80,000
Zambia[7]	27,843	24,093	[r]19,719	[r]17,031	17,000
Zimbabwe	25,351	21,953	22,305	[r]21,221	21,200
Total	[r]14,019,123	[r]14,517,265	[r]15,057,935	[r]15,122,950	14,722,728

[e]Estimated. [r]Revised. NA Not available.

[1]Recoverable content of ores and concentrates produced unless otherwise specified. Table includes data available through June 23, 1992.

[2]In addition to the countries listed, Botswana produces silver (probably 1 kilogram or less per year) and Austria and Thailand may produce silver, but information is inadequate to make reliable estimates of output levels.

[3]Reported figure.

[4]Of total production, the following quantities, in kilograms, are identified as placer silver (the balance being silver content of other ores and concentrates): 1987--20,000; 1988--34,319 (revised); 1989--58,000 (revised); 1990--52,000 (revised); and 1991--52,000 (estimated).

[5]Smelter and/or refinery production.

[6]Includes production from imported ores.

[7]Year beginning Apr. 1 of that stated.

TABLE 16
SILVER: WORLD FABRICATION DEMAND

(Metric tons)

End use	1987	1988	1989	1990	1991
Photography:					
United States	1,872	1,944	2,028	2,115	2,053
Japan	1,596	1,767	1,704	1,835	1,897
Western Europe	1,636	1,773	1,776	1,835	1,866
Total	5,104	5,484	5,508	5,785	5,816
Jewelry and silverware:					
United States	327	280	264	258	258
Japan	68	93	109	137	124
Western Europe	1,658	1,782	1,984	2,124	2,274
Total[1]	2,053	2,155	2,358	2,519	2,656
Electronic and batteries:					
United States	781	793	818	802	665
Japan	218	261	295	314	280
Western Europe	899	980	1,082	1,079	1,082
Total[1]	1,900	2,034	2,196	2,196	2,028
Other uses:					
United States	603	467	622	722	715
Japan	986	1,110	1,070	1,098	1,154
Western Europe	551	594	650	644	650
Total[1]	2,140	2,171	2,342	2,463	2,519
Other countries	2,196	2,255	2,448	2,970	2,886
Coinage	946	787	818	927	930
Grand total[1]	14,339	14,886	15,670	16,861	16,836

[1]Data may not add to totals shown because of independent rounding.
Note.—Excludes transitional economies.

Source: See footnote 28.

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